

REMARKS

Claims 1-6 are pending in the above-identified application. In the Office Action of November 3, 2004, the Examiner made the following dispositions:

- 1.) Objected to Claim 1.
- 2.-3.) Rejected Claims 1-4 under 35 U.S.C. §103(a) as being unpatentable over *Kobayashi et al.* (U.S. Patent No. 5,453,886) in view of *Kitamoto et al.* (U.S. Patent No. 4,439,796).
- 4.) Rejected Claims 1-4 under 35 U.S.C. §103(a) as being unpatentable over *Kobayashi et al.* (U.S. Patent No. 5,453,886) in view of *Kitamoto et al.* (U.S. Patent No. 4,439,796) and further in view of *Sasaki et al.* (U.S. Patent No. 5,766,766).

Applicant addresses the Examiner's dispositions below.

1.) Objection to Claim 1:

The Examiner objected to Claim 1 because of the misspelling of "said" in line 16. Applicant has amended Claim 1 to correct this typographical error.

Accordingly, Applicant respectfully submits the objection has been overcome and requests that it be withdrawn.

2.-4.) Rejection of Claims 1-4 under 35 U.S.C. §103(a) as being unpatentable over *Kobayashi* in view of *Kitamoto* and also in further view of *Sasaki*:

The Examiner rejected claims 1-4 under 35 U.S.C. §103(a) as being unpatentable over *Kobayashi* in view of *Kitamoto*. The Examiner further rejected claims 1-4 under 35 U.S.C. §103(a) as being unpatentable over *Kobayashi* in view of *Kitamoto* and further in view of *Sasaki*. Though Applicant does not necessarily agree with the Examiner's rejection, in order to expedite

allowance, Applicant has amended the claims without prejudice. However, Applicant reserves the right to pursue the subject matter of the original claims in subsequent applications.

Amended claim 1 is directed to a linear recording and reproducing system comprising a high sensitivity magnetoresistive head, and a magnetic recording medium, the recording medium further comprises a non-magnetic substrate, and a magnetic layer comprising a first ferromagnetic metal thin film layer on a surface of the substrate and a second ferromagnetic metal thin film layer on the first ferromagnetic metal thin film layer, wherein, the first ferromagnetic metal thin film layer has a columnar grain structure formed through a vacuum thin film forming technique on a surface of the substrate, and the columnar grain structure is inclined in a first direction relative to the substrate, and the second ferromagnetic metal thin film has a columnar grain structure formed through a vacuum thin film forming technique on the surface of the first ferromagnetic metal thin film layer which is inclined in a direction opposite that of the inclination of the first ferromagnetic metal thin film layer. The layers are further defined by various characteristics: $M_r \cdot \delta$, which is a product of residual magnetization M_r of the magnetic layer and film thickness δ of the magnetic layer, satisfies $3 \text{ (mA)} \leq M_r \cdot \delta < 30 \text{ (mA)}$, thickness d_1 of the first ferromagnetic metal thin film and thickness d_2 of the second ferromagnetic metal thin film satisfy $40 \text{ (nm)} \leq d_1 + d_2 \leq 100 \text{ (nm)}$ as well as $1/2 \leq d_2/d_1 \leq 1$, and coercivity H_c of the magnetic layer satisfies $H_c \geq 100 \text{ (kA/m)}$.

Regardless of what else *Kobayashi* may disclose, *Kobayashi* fails to disclose a linear recording and reproducing system comprising a high sensitivity magnetoresistive head and a recording medium, with all of the recited characteristics. Rather, *Kobayashi* discloses a magnetic recording system having a columnar grain structure for use only in a helical magnetic recording tape system. *Kobayashi*, *Kitamoto*, and *Sasaki* and any other combination thereof, fail to disclose or even suggest a linear recording and reproducing system comprising a high sensitivity magnetoresistive head and a magnetic recording medium with the recited characteristics.

As discussed in the specification, prior art recording media in combination with linear magnetic recording and reproducing systems produced unacceptable recordings. At best, if the media of *Kobayashi* were to be used in a linear recording system, there is no evidence that it would produce acceptable recordings. In that regard, the specification states:

As described above, in an oblique evaporated tape with which recording/reproducing is carried out in both directions, due to the anisotropic columnar structure of the oblique evaporated films, there is a problem which is that recording/reproducing characteristics differ depending on the direction in which a head slides. Not only is the conventional magnetic recording medium, in which two layers of oblique evaporated films having different directions of growth are layered, not suitable for reproducing with MR heads or GMR heads, but reproduced output also decreases dramatically if the magnetic layer is made thinner or the recording wavelength shorter. In other words, with a conventional recording medium, in which two layers of oblique evaporated films having mutually different directions of growth are layered, high density recording/reproducing cannot be carried out in a linear magnetic recording/reproducing system that uses an MR head or the like.

See pg, 7, line 30 - page 8, line 12.

However, Applicant has discovered that by imparting a number of unique characteristics to a medium, such as those claimed, acceptable recordings and reproductions can be obtained. In that regard, the specification states:

The present invention is made in view of the problems above, and provides a magnetic recording medium that allows for high density recording and which is suitable for reproducing signals using a magnetoresistive head and for linear recording/reproducing.

An embodiment of a magnetic recording medium related to the present invention may be comprised of a tape-shaped non-magnetic substrate, and a magnetic layer having an oblique columnar structure and which is formed through a vacuum thin film forming technique on a principal surface of the non-magnetic substrate mentioned above, where the magnetic layer mentioned above has a first ferromagnetic metal thin film, and a second ferromagnetic metal thin film formed on the first ferromagnetic metal thin film mentioned above and whose direction of growth of the oblique columnar structure is in the direction opposite to that of the first ferromagnetic metal thin film mentioned above. $M_r \cdot \delta$, which is the product of the residual magnetization M_r and the thickness δ of the magnetic layer mentioned above, is within the range $3 \text{ (mA)} \leq M_r \cdot \delta < 30 \text{ (mA)}$. The thickness d_1 of the first ferromagnetic metal thin film mentioned above and the thickness d_2 of the second ferromagnetic metal thin film mentioned above has such a relation ship where $40 \text{ (nm)} \leq d_1 + d_2 \leq 100 \text{ (nm)}$, and

$1/2 \leq d_2/d_1 \leq 1$. The coercivity H_c of the magnetic layer mentioned above satisfies $H_c \geq 100$ (kA/m).

By keeping the product $M_r \cdot \delta$ of the residual magnetization M_r and the thickness δ of the magnetic layer within the range mentioned above, an MR head or GMR head can be prevented from saturating while reproducing signals, and it becomes possible to reproduce signals using high sensitivity MR heads and GMR heads. In addition, by keeping the overall thickness δ (which is $d_1 + d_2$) of the magnetic layer within the range mentioned above, $M_r \cdot \delta$ can be kept within the range above.

By keeping the ratio d_2/d_1 of the thickness of the two layers of ferromagnetic films within the range above, the difference in recording/reproducing characteristics between the two directions for performing linear recording/reproducing can be reduced. By keeping the coercivity H_c of the magnetic layer within the range mentioned above, the required reproduced output can be obtained. High density recording is made possible by adopting the magnetic recording medium of the present invention in various linear magnetic recording/reproducing systems including those for use in tape streamers.

See pg, 8, line 13 - page 9, line 18.

It is submitted that it is only through Applicant's discovery of the claimed characteristics used in a linear magnetic tape recording system to produce acceptable high density recordings that the claimed combination arose.

Accordingly, Applicant respectfully submits the claims are patentable over the cited art.

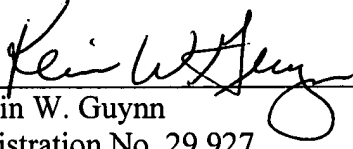
CONCLUSION

In view of the above amendments and remarks, Applicant submits that the application is now in condition for allowance, and respectfully requests early and favorable notification to that effect.

Respectfully submitted,

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By: _____


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